Addressing the 'Wicked Problems' of Sustainability through Consciousness-Based Education

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SUMMARY

In order to imagine and then create a sustainable future, education will have to be significantly rethought and redesigned. Starting from the United Nations' *2030 Agenda for Sustainable Development*, we tackle the competencies, and then the curricula and methods, that education will have to adopt in order to successfully pursue this agenda. After identifying outstanding issues in competencies, curricula and methods, we introduce a new agenda for education structured around developing the consciousness of the knower, or learner, as a basis for improved teaching and learning.

This new agenda, which addresses several of the issues of Education for Sustainability, is called Consciousness-Based Education, first introduced by Maharishi Mahesh Yogi in the early 1970s. At the end of this paper, we present a model that integrates the development of consciousness into higher education for sustainability.

INTRODUCTION

Since the United Nations' *World Commission on Environment and Development* in 1987, the term 'sustainability' has become the umbrella term related to a host of problems which threaten at least the standard of living for most of the people around the globe, and possibly the survival of the species. These problems, due to their complexity, their mix of technical and definitional issues, and their intractability have also been identified as 'wicked problems', i.e., problems with no right answer—only good and better solutions (Rittel & Webber, 1973; Pryshlakivsky & Searcy, 2013).

Whether we think of these problems as inconvenient truths or a crisis, whether we contemplate slowing or reversing current trends, whether we even believe at this point that sustainability is possible, certainly, improvements in education must be at the center of any long-term plan for a sustainable future. As the American Philosopher, John Dewey, so eloquently put it 120 years ago:

> By law and punishment, by social agitation and discussion, society can regulate and form itself in a more or less haphazard and chance way. But through education society can formulate its own purposes, can organize its own means and resources, and thus shape itself with definiteness and economy in the direction in which it wishes to move. (Dewey, 1897, p. 80)

At the same time that education is central to shaping society and solving the problems which threaten our future, clearly it is a new kind of education that is needed. Education, at least as it was for today's government leaders, is largely responsible for the problems, including the 'wicked problems', we face today, and so we can hardly think that more of the same approach to education is likely to address the problems we face.

What kind of education, then, will be at the center of our long-term plan? This is the question we seek to answer in this paper, though not in the halls of government, but in our schools and colleges. After identifying the problems that *Education for Sustainability* (EfS) seeks to address, we will begin with a brief review of the state of EfS, its

competencies, curricula, and methods of teaching and learning, and finally propose improvements for the field to consider.

EfS is growing rapidly, with more than half a dozen journals focusing on it[1], and there are nations (such as the U.S.) which are moving this focus up the ladder of their priorities[2]. We will see that education for sustainability, as with educational reform in general, is pointing more and more in the direction of competencies in systems thinking, anticipatory thinking, normative thinking, strategic planning, and interpersonal skills. In teaching methods, education is trending toward real world learning, critical problem solving, and experiential learning—all in an attempt to more directly and deeply affect behaviour.

We agree that new and developing pedagogies for problem-solving and experiential learning are important innovations that must continue, but we do not think they are sufficient in themselves to solve the wicked problems they are purported to address. However, we also posit that they may not be sufficient to transform the world-views, institutions, and technologies (WITs) that compose modern culture (Beddoe, *et al.*, 2009; Murphy, *et al.*, 2009). Something more is needed to change the WITs that have led us to the position we are in today—something deeply transformative, universally applicable, and interdisciplinary by nature.

This 'something more', we will argue, is called Consciousness-Based Education (CBE), an approach to education which integrates the best of modern western approaches to knowledge, including the innovative goals and pedagogies of EfS alluded to above, with a subjective science of consciousness, called Maharishi Vedic Science (see Fergusson, *et al.*, 2017 for a discussion of Maharishi Vedic Science and its relation to sustainability science). CBE was created in the early 1970s by Maharishi Mahesh Yogi working together with educators from around the world. It includes new technologies—especially the Transcendental Meditation and TM-Sidhi program—for developing human consciousness in ways not found in current educational practice.

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[1] There are five journals and one magazine in English focused on education for sustainability. There are another four journals focused on environmental education.

[2] A particularly striking example of this is the National Sustainability Education Summit sponsored by the U.S. Department of Education in September 2010.

Putting together these techniques and programs for personal development with a scientific, transdisciplinary framework that integrates western and eastern knowledge leads to an approach that can be said to transform individual life from its foundation in 'self-knowledge', from its basis in knowledge of one's own Self. This educational approach, we will argue, has the best chance of addressing today's wicked problems and transforming the WITs of today in the direction of the United Nations Organisation's goals for sustainable development.

GOALS AND COMPETENCIES OF EDUCATION FOR SUSTAINABILITY

When asking what kind of an education is needed for a sustainable future, the starting point would logically be a set of goals for sustainability education, identifying the knowledge, skills, and attitudes we hope to achieve with students of sustainability. To begin thinking about goals for sustainability education, however, we much first adopt a set of *Sustainable Development Goals* that envision the future state that we want our students to be competent to achieve—especially in view of the fact that this future state is probably very different from the life they are leading now.

Many organizations and groups have made attempts to set the sustainability goals, including but not limited to, the *Millennium Project* (2014), the United Nations Environmental Programme (UNEP), Worldwatch, and many of the national academies of science around the world. There is much overlap among these sets of goals, but we choose as our starting point probably the most widely accepted of these goal sets taken from the resolution adopted by the UN General Assembly on 25 September 2015, called "Transforming our World: The 2030 Agenda for Sustainable Development." In it, the United Nations (2015) identified the 17 goals presented in Table 1.

We invite the reader at this point to take a moment and reflect on what kind of a school he or she might build to prepare students to achieve these goals. Consider what would it take in terms of curriculum, instruction and assessment? Does the current range of offerings in a school prepare students to understand and address the wicked problems implied in the discrepancy between the current world and the

goals espoused here—especially in light of the fact that the problems are cross-disciplinary and challenge the status quo? Would it be a separate course or is it something we should infuse into all the existing courses? Does the school itself run in accord with these goals? What kind of a person could be a leader in sustainable development and capable of solving these problems?

Table 1. Sustainable Development Goals from "Transforming our World: The 2030 Agenda for Sustainable Development."

Goal 1.	End poverty in all its forms everywhere;
Goal 2.	End hunger, achieve food security and improved nutrition and promote sustainable agriculture;
Goal 3.	Ensure healthy lives and promote well-being for all at all ages;
Goal 4.	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all;
Goal 5.	Achieve gender equality and empower all women and girls;
Goal 6.	Ensure availability and sustainable management of water and sanitation for all;
Goal 7	Ensure access to affordable, reliable, sustainable and modern energy for all;
Goal 8.	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all;
Goal 9.	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation;
Goal 10.	Reduce inequality within and among countries;
Goal 11.	Make cities and human settlements inclusive, safe, resilient and sustainable;
Goal 12.	Ensure sustainable consumption and production patterns;
Goal 13.	Take urgent action to combat climate change and its impacts[3];
Goal 14.	Conserve and sustainably use the oceans, seas and marine resources for sustainable development;

[3] Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss;

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels; and

Goal 17. Strengthen the means of implementation and revitalize the *Global Partnership for Sustainable Development*.

These 17 goals are the broadest picture of what we are aiming at with sustainability, but the issue of how we actually achieve this kind of world brings us to another level of outcomes altogether: learning outcomes for the programs or courses designed to prepare students to address the problems and move toward the 17 Sustainability Development Goals. The generation of such outcomes is still relatively new, the earliest references being in the mid-2000s, but Table 2 shows four such sets of outcomes.

We have placed Wiek, *et al.* (2011) first in the left column because they are the most recent and comprehensive synthesis, summarizing eight other authors. Where the competency or outcome was similar among authors, we have listed them in the same row, though sometimes with different wording; where the goals themselves are different between authors, we have left the corresponding cells open.

If we look at the Table 2 further, we note several interesting similarities and differences between the competencies listed. As for similarities, systems thinking, some kind of foresightedness or thinking about the future, action orientation, and the ability to work with and motivate groups, are common to all of the writers. An ability to recognize and work with values is common to three of the four. And while Wiek, *et al.* (2011, p. 9) write that "The capacity to understand, embrace, and facilitate diversity across cultures, social groups, communities, and individuals is recognized as a key component of [Interpersonal competence]," de Hann (2006) and Cloud (2010) bring this capacity to the status of a separate competence in their "reflection

on cultural models" and "Cultural Preservation and Transformation" respectively.

Cloud also includes in her 'standards' several complex concepts (sustainable economics, sense of place, and Natural Laws and Ecological Principles), raised to a status of outcomes, whereas Wiek, *et al.* (2011) refer to five to nine 'concepts' under each of their competencies that must be taught in the context of developing the competencies. In none of these do they refer specifically to what Cloud calls 'Natural Laws', or what we might call 'subject-matter content' from, for example, chemistry or biology. They do not refer either to economics or sense of place. (Interestingly, Cloud [2010, p. 173] defines sense of place as "The strong connection to the place in which one lives: students will recognize and value the interrelationships between the social, economic, ecological, and architectural history of that place and contribute to its continuous health"—a concept unique among all the authors).

There are many issues that surround trying to identify competencies (Wiek, *et al.*, p. 201). One of the main issues is that sustainability competencies overlap with what could be called general education competencies. The American Association of Colleges and Universities LEAP Project (AACU, 2015), for example, identifies among its twelve outcomes Civic knowledge and engagement—local and global; Ethical reasoning and actions; Synthesis; and advanced accomplishment across general and special studies. These outcomes are all parallel to several of the Wiek, *et.al.* (2011) competencies. Thus, separating out the relative responsibilities in college of general and special faculties for these competencies will be important, as will be separating out which competencies are unique to sustainable studies programs from those competencies that are to be attained by all students.

A second issue centers around the lack of reference, especially in the Wiek *et al.* (2011) set of competencies, to dispositions. De Hann has two that are clearly dispositions and Cloud has two that could be called affective skills, but on the whole the important dispositions, such as caring about the environment and the welfare of others do not seem to be given the prominence that they should be given.

Table 2. Alternative sets of competencies, outcomes or standards for programs that teach sustainability research and problem solving.

Wiek, Withycombe, & Redman (2011)	de Hann (2006)	Redman (2013)	Cloud (2010)
Systems thinking competence	Interdisciplinary work	Systems thinking and understanding of connectedness	The dynamics of systems and change
Anticipatory competence	Foresighted thinking	Long-term foresighted reasoning and strategizing	Inventing and affecting the future
Normative competence	Cosmopolitan perception, transcultural understanding, and cooperation		Multiple perspectives
Strategic competence	Planning and implementation	Action-orientation and change agent skills	Responsible local and global citizenship
Interpersonal competence	Participatory skills	Stakeholder engagement and group collaboration	Healthy commons
	Distanced reflection on individual and cultural models		Cultural preservation and transformation
	Capacity for empathy, compassion, and solidarity		
	Self-motivation and motivating others		
			Sustainable economics
			Strong sense of place
			Natural laws and ecological principles

Other writers have noted the importance of dispositions, but we were unable to find an author who has attempted to identify key dispositions (cf. Barth, et al., 2007, for one who emphasizes the importance of dispositions but without articulating them). Even critical thinking, for example, viewed by many as a cognitive skill, we know to be strongly intertwined with the disposition for fair-mindedness and openness to alternative points of view (Lipman, 2003, p. 132; Danvers, 2015, p. 1). We suspect the same is true of sustainable competencies: they are intertwined with dispositions to care about the welfare of others and to make a better world.

This issue is tantamount to whether the competencies can be divorced from personal values or ideological stances which Wiek *et al.* note as well, without resolving:

> …some authors argue that the normative character of sustainability requires the acquisition of certain values (social-ecological integrity, justice, etc.). Others argue that sustainability graduates need to know different value-laden concepts, but their role is to facilitate dialogue rather than position themselves in value-laden debates (2011, p. 211).

We believe this issue can be resolved if we can accept that there may be some values, such as care for others or self-actualization, which are fundamental to progress by any point of view. From this perspective, values and needs are aligned with a fundamental drive for community, or for self-actualization. This is of course an ideological stance, but one that can be supported by biology (Piaget, 1971) and psychology (Maslow, 1954). Thus, we take the stance that so-called 'value-laden concepts', as long as they are values for self-actualization, self-determination and well-being, are no more values than they are requirements of sustainability. Sustainability itself, then, becomes the primary value and cognitive focus at the same time.

A fourth issue, not raised by Wiek, *et al.* (2011), is the distinction between working on one's own worldview and its attendant behaviours, or helping others to do the same—similar to the issue of where healing oneself fits into becoming a doctor who heals others. One might ask whether changing others necessitates first trying to change oneself and one's behaviour. Or, putting it more positively, learning to

change oneself and one's life style is important work for the would-be change maker. If there were an effective technology for developing the perception, cognition, and behaviour of the student, this technology should be part of any sustainability science program.

This consideration leads us to a competency that should be added to the lists we outlined above. This is competency related to the *person* who is to be a sustainability researcher or problem solver, to the wholeness of that person that is more than the sum of the parts. And by this 'more' we are not referring to the personality of the would-be sustainability worker, but to the underlying person, what CBE refers to as the 'knower', or individual self. Wiek, *et al.* take a step in this direction when they state:

> Our analysis emphasizes individual sustainability competence while positioning it within a sustainability research and problem-solving framework. Yet, the overarching competence in sustainability research and problem solving is more than the sum of its parts. It involves not only the mastery of the individual competencies but also the *ability* [our emphasis] to combine these competencies in a meaningful and effective way. Analyzing and solving sustainability problems requires linking and activating all of the individual competencies… (2011, p. 10)

This kind of wholeness of awareness that connects all the parts and integrates them in an effective way is the specialty of Consciousness-Based Education. We will argue (in more detail later) that there is a holistic quality of consciousness that needs to be cultivated in the student of sustainability—both as direct experience within oneself, and as a unifying concept necessary for the interdisciplinary, systems-oriented work that is so central to sustainability education. In short, there should be a competency for experiencing and understanding wholeness in one's own life and in the world around one. This is needed to connect all the competencies together in a transdisciplinary whole and to make them effective in the world.

At our home institution, Maharishi University of Management (MUM) in Fairfield, Iowa, the faculty have developed "Essential Learning Outcomes" for all undergraduate students (Jones, 2017). Two of these outcomes are specifically aimed at development of

consciousness and holistic thinking. They currently are framed as follows:

> **Development of Consciousness**: College graduates will be able to display improvements in perception, thinking, feeling, and overall growth of consciousness; and
> **Holistic Thinking:** College graduates will be able to apply unifying principles within and across disciplines to synthesize ideas, integrate divergent perspectives, and understand what they have learned in light of their own consciousness.

The exact language and measuring tools for these two competencies in the context of college education continue to evolve, but MUM has both objective and self-report measures for both of these general outcomes and nearly 40 years of research with objective measures of development of consciousness (Jones, 1987; Travis, 2009).

In summary, based on the evolving goals of sustainable development and sustainability science, many authors have tried identifying what students should know and be able to do at the end of a program or school career to prepare them to be researchers or students of sustainability science. We take Wiek *et al.* (2011) to offer the most definitive and comprehensive attempt to articulate such outcomes (or competencies) to date, with several notable possible additions and a few salient issues to keep in mind.

Not the least of the issues is the need for some attention to the whole that is more than the sum of its parts, the whole person who is trying to change his or her life and help other individuals and groups do the same. We will return to these issues after a discussion of the teaching and learning strategies for sustainability.

CURRICULUM AND TEACHING FOR SUSTAINABILITY

One of the early attempts to outline EfS was the Rio de Janeiro Earth Summit of 1992. Chapter 36 of Agenda 21 from the summit, "Promoting Education, Public Awareness, and Training" (UNCED, 1992) outlined the programs of action, including objectives and activities, which educators could use to promote sustainable development and improve "the capacity of the people to address environmental and development

issues." Section 5(f) of the document specifically points out the need for new pedagogies, suggesting that "educational authorities should promote proven educational methods and the development of innovate teaching methods for educational settings." In response to this call to action, numerous sustainability education programs and initiatives have been developed and implemented around the world (see for example, Sterling, 2001; UNESCO, 2002; Williams & Brown, 2013; and Padmanabhan & Singh, 2016).

The resulting EfS programs and curricular initiatives have ranged from stand-alone courses to degree programs in colleges and universities to institutions that integrate sustainability across the curriculum. Church and Skelton (2010) identified four different approaches to integrating sustainability in education, including: (1) sustainability as the context within which to teach core subjects; (2) sustainability projects in standard courses; (3) sustainability as its own course or degree; and (4) sustainability at the school-wide or district-level to guide institutional and curricular innovation.

K-12 education has demonstrated the most vitality and innovation when it comes to methods of teaching. Programs designed to integrate sustainability have emphasized best practices in teaching and learning, especially pedagogical methods that involve real-world, problem-based, experiential approaches (Church & Skelton, 2010; O'Brien, 2010; Sterling, 2001; Williams & Brown, 2012; UNESCO, 2002).

For example, at our home institution, students study soil biology and organic farming in the context of broader issues of food quality and security. As part of this study, students conceived a composting project that quickly grew into a composting process for the whole University. Students created the means to collect food scraps at each meal and turn these into compost for the University's greenhouses, as well as those of local farms. Students learned not only how to compost and replenish the soil; they also learned how to work with kitchen staff to collect leftover food and turn it into compost. Such methods serve to advance the call made by reformers such as Sterling (2001) to move away from "transmissive" learning to "transformative" learning where, through "whole systems thinking," students can be better prepared to respond to the challenges of sustainability in an organization, like a college.

An example of a particularly detailed treatment of strategies for teachers is UNESCO's professional development resource for teachers

titled *Teaching and Learning for a Sustainable Future* (UNESCO, 2002). This site provides material for pre-service and in-service teachers to enable them to integrate the concepts and themes of sustainable development into the school curriculum. The program contains modules with different themes that revolve around sustainability and innovative pedagogy.

A key objective of the program, therefore, is "to enhance skills for using a wide range of interactive and learner-centered teaching and learning strategies that underpin the knowledge, critical, thinking, values and citizenship objectives implicit in reorienting education towards sustainable development" (UNESCO, 2002, p. 5). The key teaching and learning strategies that the UNESCO program recommends include experiential learning, storytelling, values education, enquiry learning, future problem solving, learning outside the classroom, and community problem solving.

Individual educators and researchers in colleges and universities have also developed programs, resource materials, and books that teachers have used to integrate sustainability in their classrooms. Williams and Brown (2011), in their influential book *"Learning gardens and sustainability education: Bringing life to schools and schools to life,"* describe how, through learning gardens in schools, students can learn about sustainability in an engaging, meaningful way, through real world experiences. Learning gardens, according to Williams and Brown, provide a whole-system solution to the issues of sustainability. They identify several key schools and programs across the USA that have successfully integrated school gardens in teaching and learning[4].

One of us (Dr Akura) is engaged in the region of Lake Victoria, Kenya, using this methodology. He currently helps teachers introduce Kenyan school children to the concepts of sustainability through learning gardens. Students learn about food supply, water quality, bio-diversity conservation, and energy use as they create their own school gardens. They begin to apply whole systems thinking naturally as they see the interdependence of these four issues in their own gardens.

At the school where the authors have consulted, Maharishi School of the Age of Enlightenment (MSAE) in Fairfield, Iowa, a Consciousness-

[4] These include the Edible Schoolyard Project at Martin Luther King Junior School in Berkeley, California (The Edible Schoolyard Project, 2017), the Common Roots (2017) program in Vermont, and the Garden Initiative in Chicago, Illinois.

Based institution, as well as promoting development of consciousness and teaching holistic thinking, teachers integrate the concepts of sustainability through project-based learning as well a high school-level course in sustainability (Nidich & Nidich, 1989). Students have undertaken projects such as rain catchment, as well as designing pizza gardens and edible food plots.

Students learn about botany and agriculture first hand in a 4,100 sq ft (38 m^2) greenhouse in the schoolyard. The lower school also has utilized the Nature Explore Classroom program sponsored by the Arbor Day Foundation where pre-school children grow in awareness and appreciation of the earth. In the accompanying high school, a sustainable living elective course has also been offered (MSAE, 2015).

Research projects of various sizes and durations have been conducted on sustainability education curriculum over the years. An example of a small-scale research project is found in Redman (2013), who investigated sustainability competencies and transformative change in sustainable behaviours among a small group of students in Phoenix, Arizona. The case study research demonstrated a significant change in student knowledge and sustainability behaviours.

A bigger curriculum research program touching on food systems and nutrition—and important component of sustainability—is the Linking Food and the Environment (LiFE) research project developed at Teachers College, Columbia University (LiFE, 2005; Calabrese Barton, *et al.*, 2005). The LiFE curriculum aims at promoting scientific habits of mind and knowledge about food systems and the environment among youth living in urban poverty in the USA. This project has demonstrated that sustainability curricula in schools or in after-school programs can promote sustainable behaviours among students.

Whereas a lot of resources have been developed to bring the concepts of sustainability in the classroom through projects and as tools to teach core subjects, it is in the approaches where sustainability is taught as its own subject, as well as where sustainability initiatives are implemented at institutional levels—school-wide, district-level, or in universities and colleges—where the most significant work has been done. According to Church and Skelton (2010), the approach to teaching sustainability as its own subject can be divided into three categories, including teaching sustainability as an entire course, sustainability

taught as a thematic unit, and incorporating sustainability as a single lesson.

Examples of colleges in the U.S. that offer sustainability majors or degree programs include the School of Sustainability at Arizona State University; Maharishi University of Management in Iowa; and Santa Clara University in Santa Clara, offering a Master of Science in Sustainable Energy degree. Apart from offering degree courses in sustainability, these universities, as well as hundreds of other universities in the USA, offer courses with a focus on sustainability science in different departments and disciplines (Best Colleges, 2017).

In 2014, for example, Santa Clara University offered nearly 800 courses with an environmental or sustainability focus. Others include Michigan State University, offering 15 environmental or sustainability focused majors or specializations (MSU, 2017), and Stanford University, which offers about 500 courses on sustainability in different departments and disciplines (Best College Rankings, 2017).

Thousands of colleges and universities in the USA and around the world have also committed to "greening their campuses" through environmentally friendly operations and research on sustainability. The University of Indonesia has developed a ranking system, the GreenMetric World University Ranking, which ranks universities on various sustainability issues (Greenmetric UI, 2015). Such commitments provide students with opportunities to learn about sustainability through active engagement on the various greening projects on campus and to see working models of sustainable development.

The main challenge to sustainability research and problem solving arises largely from the highly compartmentalized organization of the modern university and secondary schools. Faculty in biology, literature, and foreign language are, due to the organization of the academy, not ideally equipped to deal with interdisciplinary issues. Beyond curriculum compartmentalization, the major issues or limitations are mostly due to limitations in teacher preparedness.

Few teachers in secondary or tertiary education are provided the background knowledge to teach sustainability as its own subject, even if they are biology teachers. Fewer still are trained in the more advanced pedagogies of enquiry learning or project-based learning. Even fewer have the understanding or skills to teach systems thinking,

interdisciplinary research, or problem-solving in an interdisciplinary context. (Mills & Tomas, 2013; Sims & Falkenberg, 2013; Hopkins & McKeown, 2005).

ISSUES AND CHALLENGES FOR SUSTAINABILITY EDUCATION PROGRAMS

As we can see from the previous section, EfS has been moving in the same direction as mainstream educational reform, toward a student-centered, project-oriented, critical, constructivist, inclusive approach to teaching and learning. The emphasis in teaching over the last two decades has shifted from the teacher as authority, delivering knowledge, to a more interactive, process orientation, focused on student learning. In short, EfS, like education generally, has become process oriented—at least as espoused by its lead reformers. While adopting these advances, several challenges or issues remain to be addressed. Recounting, they are

1. **Distinguishing general from special competencies.** As mentioned above, in a school or college one of the decisions that comes first is what do all students need to know and what do only those interested in the subject need to know? A challenge that remains is where to draw the line between the general and special competencies that are needed by graduates from sustainability science programs.

2. **Adding dispositions and values to student learning outcomes.** Dispositions and values must be included in any comprehensive list of desired outcomes. If we didn't care about supporting a good quality of life for our children and their children, the field of sustainability science would not exist. Thus, the commitment to the future and to the people who will live in the future must be systematically cultivated and frequently discussed. A challenge remains to articulate these dispositions. (For an interesting comparison, see the history of identifying dispositions in teacher education in Villegas [2005].)

3. **Teaching both sustainable living and sustainability science.** It seems that any sustainability program should address both the life of the student (we call it "sustainable living") and policies and strategies for improving the world around us (sustainability science). The two domains are intertwined, but it is the authors' position that both should be taught explicitly (even if under the broad heading of "sustainability science"). A challenge remains here to articulate goals and teaching strategies to develop both the student and the subject matter expertise.

4. **Moving toward transdisciplinary study and wholeness.** Many authors (e.g., Steinfeld & Mino, 2009; Ferrer-Balas, *et al.*, 2008) have pointed out the radically interdisciplinary nature of sustainability science, cross-cutting as it does social science, physical science, and the humanities. In light of this challenge, approaches best equipped to pursue EfS are those which go beyond collaboration of experts in a number of fields (interdisciplinary study) toward identifying methods and unifying principles—principles that capture fundamental patterns at the root of many disciplines (e.g., Boothby, 2007; Winquist, 1982; Leavy, 2011). Thus, sustainability science is in need of a transdisciplinary bridge to connect the natural sciences, social sciences and the humanities, and to identify such unifying principles.

5. **Compartmentalization of modern discipline-centered instruction.** It is difficult to get faculty to focus on skills or knowledge that does not arise in their home discipline. If the institution does not make an effort to develop interdisciplinary knowledge or skills, then it will be difficult to find a place for the study of a knew discipline, such as sustainability science. Such subjects are often relegated to electives and so the first to get cut in challenging budgetary times (Hopkins & McKeown, 2005).

6. **Faculty lack training in EfS and its more advanced pedagogies.** For EfS to make significant inroads in academia it must upgrade the knowledge and training of its faculties to include background knowledge and skills necessary to change

student worldviews and behaviours. The kinds of knowledge and skills necessary are new, however, and must be introduced first in teacher education institutions and then in higher education faculty training.

THE BASIC FRAMEWORK OF CONSCIOUSNESS-BASED EDUCATION

We will come back to address each of the EfS challenges identified above. To achieve a proper synthesis, however, we need to lay a foundation for this task in a basic overview of Consciousness-Based Education (CBE).

Consciousness-Based Education was created by Maharishi to be a complete integration of modern science and Maharishi Vedic Science. Though one can see the basic tenets around which CBE is organized as early as when Maharishi first began teaching the Transcendental Meditation technique in India in the 1950s, the educational system as a system begins to take shape in the early 1970s. At that time, institutions of elementary, secondary, and tertiary education were established[5], a new discipline called the Science of Creative Intelligence (SCI) was formulated from the Vedas[6], and the basic principles of CBE were articulated.

In a now-famous address given in 1973 to the *American Association for Higher Education* in Chicago, Maharishi introduced the basic idea of CBE in this way:

> The stream of knowledge has two banks—on one side is the object of knowledge, and on the other side, the knower. With these two points of reference, the knower and the object of knowledge, the first point of reference is the knower. This is very important, because we know that knowledge is as the knower is.

[5] Maharishi University of Management (MUM) was incorporated first in 1971 in Santa Barbara, California, moving later to Fairfield, Iowa. Maharishi School of the Age of Enlightenment was formed as a laboratory school, under the umbrella of MUM in 1974, in Fairfield, Iowa.

[6] The Science of Creative Intelligence was created by Maharishi from the Veda and Vedic Literature, but stripped of all Sanskrit terminology and easily integrated with western empirical science. It is still available as a course at Maharishi University of Management in the original video recordings of Maharishi in 1972.

> When the mind is dull, when the knower is sleepy, the knowledge is something different than what it is when one is fresh and wide awake in the morning. Perception is different, understanding is different, emotions are different. Knowledge is different in different states of consciousness (1973, p. 3).

In the same address Maharishi went on to explain that the Transcendental Meditation technique was a simple educational technology that could be used to gradually open to awareness the knowledge and experience of the knower, that which had been missing in modern educational systems. By "knower" Maharishi was not referring only to the thoughts and feelings of the learner. He explained that there was an aspect of mind that was beyond thoughts and feelings and that this transcendental self could be experienced directly by the mind. It was a unique state where the mind reflects on itself by itself—a self-referral state.

Since Maharishi first began teaching the Transcendental Meditation technique, people had had the experience of this self-referral state of consciousness. The technique itself is a simple, natural mental technique practiced twice daily for 15 to 20 minutes, and during the practice, mental activity settles down gradually to its quietest state, a state of restful alertness, where the mind is quiet but fully awake and alert. At the same time, there's a sense of expansion and peace. A typical experience is described subjectively as follows:

> During the Transcendental Meditation technique my mind settles down, thoughts become less and then suddenly all thought activity ceases and I slip into an unbounded ocean of awareness which is pure, quiet, unexcited and infinitely extended beyond space and time. I am not aware of any thought or any thing; I am just aware of awareness, you could say, wide awake inside but not thinking. Simultaneously my body settles down, breathing becomes less, and I feel relaxed. (quoted in Pearson, 2013, p. 52)

While pleasant and personally meaningful in its own right, it became clear from research that this experience of inner restful alertness, especially as it began to infuse itself into waking activity, made the mind

clearer and learning easier (Dillbeck & Dillbeck, 1987). More important, however, was the significance of this experience in light of the broader search for self-knowledge, long thought to be at the foundation of education. The experience of transcendental consciousness was presented by Maharishi as the experience of the Self, the knower, the one bank of the river in the analogy of 1973, that had been missed by conventional education. Thus, in light of the experience of the Self, the entire field of education had to be rethought (Grant & Jones, 1997).

Maharishi worked closely with professional educators to craft the new approach, and what emerged was essentially four components:

1. The traditional disciplines of western education would be taught in their completeness as before, ensuring that the most up-to-date knowledge was presented, but connected to the knower;

2. Every student would practice the Transcendental Meditation technique twice daily to ensure the experience of the full range of human subjectivity;

3. The curriculum would also include SCI, used to bridge the traditional disciplines and the new dimension of human experience brought to light by the Transcendental Meditation technique; and

4. Teachers, in addition to practicing the Transcendental Meditation technique and learning SCI, would learn new principles of teaching which would help them to use SCI to make the connections between all aspects of subjectivity and the disciplines—to develop a new kind of holistic thinking that incorporated subject, object, and the connection between the two.

Beginning in about 1980, Maharishi began to formulate a science closer to the Veda and Vedic Literature itself, but still entirely grounded in publicly available experience and the standard of scientific research, called Maharishi Vedic Science (see Fergusson, *et al.* [2017] for more details on Maharishi Vedic Science and its relation to sustainability science). Today both SCI and Maharishi Vedic Science are taught as

interdisciplinary subjects in Consciousness-Based Education. Through the combination of both the experience of consciousness during the Transcendental Meditation technique and the interdisciplinary study of it, Maharishi created a new experience-based approach to education, integrating personal experience, modern science, and traditional wisdom, especially Maharishi Vedic Science. Maharishi summarized the importance of this new approach:

> If the age is to change to one of invincibility[7] a fundamental value has to be supplied to the field of education. This missing fundamental is knowledge of pure consciousness and how to experience it. (Maharishi, 1978, pp. 148-149)

THREE SOURCES OF KNOWLEDGE FOR CONSCIOUSNESS-BASED EDUCATION

Maharishi Vedic Science is a science of subjectivity, objectivity, and the link between the two. It uses methods taken from modern science, from direct personal experience, and from "traditional wisdom," especially that of the Vedic Literature of ancient India. It triangulates the three in methods typical of the qualitative methods from social science. A simple example will clarify.

As described above, the core technology of Consciousness-Based Education is the Transcendental Meditation technique. One experience has already been shared above. Another is given here:

> When I sit to meditate and my awareness sinks into the transcendent, the concerns and worries that may have been gripping my mind fall away, and become supplanted with bliss (sometimes quiet, sometimes bubbly) and peace. The experience is very nourishing….The transcendent is a completeness. (quoted in Pearson, 2013, p. 52)

[7] 'Invincibility' is the state where a nation is impervious to negative outside influences: both at peace and internally strong, though a full explication of invincibility is beyond the scope of this paper.

This is one of hundreds of similar descriptions from people practicing Transcendental Meditation technique, portraying a unique restfully alert state at the end of the thinking process. It occurs not only through the Transcendental Meditation technique, but also—though rarely—through other practices and even without any technique, spontaneously in moments of silent reverie. We find clear, and apparently somewhat equivalent, experiences reported by Laozi, Plato, Plotinus, St. Augustine, Shankara, Attar of Nishapur, Meister Eckart, and many others, from both modern and ancient sources (Pearson, 2013, for more detail).

When scientists ask subjects to describe experiences that they have during the practice of the Transcendental Meditation technique, these experiences can be classified into transcending and other experiences (such as paying attention to thoughts). When the transcendental experiences are then linked to psychophysiological data, scientists can assemble a physiological portrait that is both consistent with the experience, unique among physiological states, and, at the same time, a physiological perspective on that experience. According to physiological research, the state is characterized by:

- significantly lower breath rates (indicative of lower metabolism);
- higher EEG alpha amplitude (indicative of greater alertness);
- higher alpha coherence (indicative of greater coordination of brain functions);
- reduced skin conductance (indicative of reduced arousal, greater relaxation);
- increased blood flow to the brain (indicative of greater brain activity);
- decreased plasma cortisol (a stress hormone); and
- and increased levels of prolactin (a hormone associated with calm alertness) (Travis, 2001; Travis & Pearson, 2000; Jevning, *et al.*, 1996; Wallace, *et al.*, 1971).

In general, this state of Transcendental Consciousness has been characterized as a distinct hypometabolic state, where the mind is quiet, yet fully alert, and the body is deeply rested and relaxed (Jevning, *et al.*, 1992). The brain is coherent, meaning the electroencephalographic

(EEG) signals from different sensors on the scalp are synchronized in phase and frequency.

When one looks to the sources of traditional wisdom, we find descriptions which apparently record such experience, including Wordsworth's famous description of his own 'transcendental' or inner experience in "Tintern Abbey", in which he writes of "That blessed mood in which…"

> the burthen of the mystery,
> In which the heavy and the weary weight
> Of all this unintelligible world
> Is lighten'd:—that serene and blessed mood,
> In which the affections gently lead us on,
> Until, the breath of this corporeal frame,
> And even the motion of our human blood
> Almost suspended, we are laid asleep
> In body, and become a living soul:
> While with an eye made quiet by the power
> Of harmony, and the deep power of joy,
> We see into the life of things.

The Vedas of ancient India were particularly focused on identifying and explaining this experience; what they called Samadhi. In the *Yoga Sutras* of Maharishi Patanjali (2010, pp. 11, 33, 37, and 39), for example, we find several relevant "sutras":

> Now is the teaching on Yoga. Yoga is the complete settling of the activity of the mind. Then the seer is established in the Self[8]…
>
> When mental activity decreases, then knower, knowing and known become absorbed one into another, like a transparent crystal which assumes the appearance of that upon which it rests.

[8] The 'Self' is often capitalized when referring to the transcendental Self, as distinguished from the individual ego that identifies with one's personal history, values and personality. To avoid having to carefully distinguish these two throughout this paper, we default to the lower-case "self" hereafter.

> In the clear experiences of *nirvicara Samadhi* dawns the splendor of the Self. There resides the intellect that knows only the truth…
>
> In the settling of that state also, all is calmed, and what remains is unbounded wakefulness.

Pearson (2013) has documented many other similar examples of what appear to be descriptions of Transcendental Consciousness, the Self, or consciousness knowing itself, covering all the major spiritual traditions of the world. The point here, however, is not to try to examine similarities and differences among these statements, but only to establish one point: Consciousness-Based Education achieves a breadth of analysis rare in the field of education because it seeks knowledge at the intersection of these three sources: direct personal experience; modern scientific experimentation, and traditional wisdom from the spiritual traditions, including indigenous traditions, and especially focused on the Veda and Vedic Literature of India.

In this one example, one can see already the overlapping perspectives on one fundamental event. We can see, for example, from all three sources that the transcending experience is characterized by bodily rest, combined with heightened mental alertness and a pervasive calm. We see also in the Wordsworth quote, as well as the research findings, a kind of harmony or coherence, as all brain functioning becomes coordinated (Travis, 2010). We see from the personal experiences and from the Vedic texts that experience of Transcendental Consciousness is a 'unified experience'.

AN OVERVIEW OF RELEVANT RESEARCH ON CONSCIOUSNESS-BASED EDUCATION

While it might be argued that knowing one's self is inherently beneficial, it is well established through research that this experience of the self is transformative for those having the experience, and the research on this transformation helps further establish its importance to EfS. More than 700 research studies on the technique have been collected in seven volumes (Orme-Johnson & Farrow, 1977; Chalmers, *et al.*, 1989a, 1989b, 1989c; Wallace, *et al.*, 1990; Dillbeck, 2011; Dillbeck, *et al.*, 2013) and yet only a few themes of this research are relevant to EfS. We will

review five traditions of research, starting with the changes in achievement and behavioural indicators that school administrators care most about and moving after into psychological and physiological change that helps explain the behavioural changes[9].

Greater engagement and achievement. EfS must be structured around an academic program that delivers a sound educational program and hopefully one that offers improvement over current practices. Students will need strong mastery of content in the disciplines to address the wicked problems of the 21st century, and Consciousness-Based Education has shown itself capable of raising overall engagement and academic achievement, as measured by standardized tests.

There are a number of studies which indicate that students who are participating in school-based programs using the Transcendental Meditation technique are more engaged in their studies than their peers who do not. The most extensive studies have been done in a large urban school district, showing a 15% greater on-time graduation than controls (Colbert & Nidich, 2013); improved performance on standardized math and English achievement tests; and improved GPA in the same school among students in the treatment group (Nidich, *et al.*, 2011). Two schools using CBE showed improvements in the Academic Performance Index (API) over nine years, when compared to other non-CBE high schools in the same district (CWAE, 2015). The API index is a government-mandated index, where every school is required to combine performance year over year on standardized academic achievement (primarily the California State Test and California High School Exit Exam tests), attendance, graduation rate and other indicators of school progress.

Though not specifically focused on academic achievement, there have been several studies showing that the regular practice of the Transcendental Meditation technique develops fluid intelligence that correlates strongly with academic achievement. Cranson, *et al.* (1989) found increases on the Cattell Culture Fair Intelligence Test (CFIT), as well as choice reaction time, a correlate of intelligence among CBE

[9] Many of these studies are on a variant of CBE, called "Quiet Time" in the U.S., which uses just student and teacher practice of the Transcendental Meditation technique, but not the Science of Creative Intelligence or the teaching principles included above in the summary of the approach.

college students, as compared with students at a nearby non-CBE institution. So and Orme-Johnson (2001) found in junior high children practicing the technique significant increases in a number of cognitive factors, including intelligence, creativity, field independence, and practical intelligence. Improved attendance and reduced suspensions were found in another large (though not urban) public school system (Barnes, *et al.*, 2003). Researchers found similar results in a private high school where students performance on standardized measures improved relative to state-wide norms (Nidich, 1989). CBE has also been shown to support teacher resilience. In Vermont, the Transcendental Meditation technique was found to be effective in reducing psychological distress in teachers and support staff working in a therapeutic school for students with behavioural problems (Nidich, 2014).

Reducing stress and psychological distress. Stress is an important factor to address in sustainability education because stress inhibits students' abilities to see the world as it is and deal effectively with it. Chronic stress contributes to reactive thinking, rather than strategic, systems thinking identified above. In addition, stress and anxiety contribute to a sense of hopelessness and the kind of downshifting that looks only to getting by in the current situation. 'Just getting by' is a hallmark of non-sustainable behaviours.

Over the last 30 years, neuroscience has begun to examine in detail the effects of stress on brain function, and it is well established that chronic stress, in addition to harming health and physiological functioning, inhibits cognitive functions and is a significant risk factor for violent and anti-social behaviour (e.g., McEwen, 1998, 2012). The general picture that emerges from cases of chronic stress is that stress is associated with structural remodelling of brain—that is the strengthening and proliferation of some neural pathways and the weakening and atrophying of others. Stress causes regions involved in memory and emotions, such as the hippocampus, amygdala, and prefrontal cortex to be weakened, with the result that memory is impaired and anxiety and aggression are increased. Chronic stress has also been associated with lowered serotonin and high levels of cortisol, which in turn are associated with depression, immune disorders, and heart disease (Travis, 2008).

Even mild stress that is continuous and unavoidable has been found to cause "downshifting" in the brain "to more traditional, more familiar, cruder behaviour—to what we would do if we had much less brain" (Hart, 1983, p. 128, in Caine & Caine, 1994). Downshifting gets its name from the shift of brain systems from the more sophisticated and integrated response of the pre-frontal cortex to a stimulus-response mode characterizing the older, more automatic limbic system and reptilian complex. The R-complex does not reason, it reacts. In other words, we seek to avoid and protect ourselves from repeated stress that is beyond our capacity to manage. We slip into a simpler mode of behaviour that minimizes unwanted stressors and avoids reflective, reasoned responses that have shown themselves to be relatively useless. It is easy to see how this state may occur in schools that require students to sit through classes where they may feel threatened or at continuous risk of failure.

Transcendental Meditation has long been known to have an ameliorative effect on stress and its first consequence, anxiety. As mentioned briefly above, compared to eyes-closed rest, prior physiological research has found that Transcendental Meditation is characterized by decreased activation or arousal, as reflected in decreased breath rate and lower sympathetic tone (Dillbeck & Orme-Johnson, 1987; Jevning, *et al.*, 1992). It is associated as well with higher parasympathetic tone, as reflected in amplitude of the high frequency component of heart rate variability, also called respiratory sinus arrhythmia (Travis, 2001). The structural remodelling caused by stress, and due to repeated stimulus-response channels, is mitigated by bringing online areas of the brain that have been circumvented. The downshifting associated with stress can be compensated for by restoring the cortical-thalamic (cortex to mid-brain) connections, leading to a renewed tendency to think before one acts. The higher parasympathetic tone (high arousal) can be reduced, leading to a more balanced, relaxed awareness able to more rationally assess threats and responses to threats.

Several studies have shown that psychological distress can be decreased in non-school populations. A meta-analysis of 146 studies with adults by Epply, *et al.* (1989) showed the effectiveness of the TM technique compared to other meditation and stress reduction programs in reducing anxiety. Research has also shown reductions in depressive

symptoms and emotional distress (Sheppard, *et al.*, 1997; Aaron, *et al.*, 1981). A recent study of racial and ethnic minority high school students corroborated these broader studies when it found significant reductions in psychological distress and anxiety (Elder, *et al.*, 2011, 2014); another found similar results for college students, where blood pressure and psychological distress were both reduced (Nidich, *et al.*, 2009).

Increasing brain coherence and performance. As we have seen above, EfS requires systems thinking, interdisciplinary thinking, and holistic thinking that integrates head and heart. A third tradition in the research on the Transcendental Meditation technique looks at brain functioning and its effects on performance. The kind of brain function brought out in this research draws upon and coordinates all parts of the brain, from brain stem to cortex, from front executive functions to parietal and occipital functions more associated with perception and memory.

Early researchers looking at the brain physiology of people practicing the technique noticed coherence, or synchrony of phase and frequency, between the Electroencephalographic (EEG) outputs on different parts of the scalp, especially in the Alpha1 (8-10 Hz) range. In addition, they found increases in frontal and central alpha1 power (Banquet, 1973; Levine, *et al.*, 1975; Hebert & Lehmann, 1977). Alpha activity has been associated with cortical idling, but may also be associated with inner wakefulness, the ground of outer experiences (Travis, *et al.*, 2010).

Brain wave coherence is important, it was reasoned, because as different parts of the brain work together, the amount of brain resources that can be applied to any task increases. Recent research suggests that Alpha EEG synchrony coordinates brain areas for conscious awareness, attention, efficient transmission of sensory information, multisensory coordination, perception, working memory and fine motor behaviour (Thatcher, 2012). A recent study even indicates that connectivity strength in the resting brain, as measured by EEG coherence, may be the neural mechanism of general intelligence (Lee, *et al.*, 2012). Coherence also helps us understand how the Transcendental Meditation technique, the core of Consciousness-Based Education, works. It also helps us understand its value to education.

High alpha coherence during the Transcendental Meditation technique, for example, is correlated with:

- neurological efficiency (Dillbeck, *et al.*, 1981; Wallace, 1983);
- creativity (Orme-Johnson & Haynes, 1981; Travis & Lagrosen, 2014);
- concept learning (Dillbeck, *et al.*, 1981; Dillbeck & Vesely, 1986);
- academic performance (Nidich, 1989);
- moral reasoning (Travis & Arenander, 2006; Nidich, 1983);
- intelligence (Orme-Johnson, *et al.*, 1989); and
- emotional stability (Travis & Arenander, 2006; Orme-Johnson, *et al.*, 1989).

Another source of understanding what is happening in the brain during Transcendental Meditation comes from research on the brain's default mode network (DMN). Recent research indicates that the brain maintains two parallel networks. One, called the default mode network, is associated with the sense of self. It's active, for example, during the construction of a biography; it's also more active whenever the mind is wandering or not responding to external stimuli. The other, the thalamic-cortical axis, is associated with the processing of sensory and memory inputs—content generally.

As one might expect, the Transcendental Meditation technique seems to enliven the DMN, but the interesting finding is that the Transcendental Meditation technique creates higher DMN activation than eyes closed rest, suggesting that the practice is different than just autobiographical or mind-wandering thoughts. More than enlivening the DMN, the Transcendental Meditation technique may contribute to just the wakefulness and coordinating power of this network. Travis, *et al.* speculate that "Transcendental Meditation experiences may be as foundational to the eyes-closed resting default state, as eyes-closed rest is to extrinsic, localized modes of cognitive processing" (2010, p. 28).

How does this quietly alert brain affect performance? The correlates of EEG coherence listed above give a sense of the broad range of psychophysiological effects. Recently Travis has created a Brain Integration Scale involving three EEG measures recorded during challenging tasks: 1) higher broad and coherence in frontal executive areas of the brain; 2) higher alpha relative power; and 3) efficiency in

brain functioning (a measure of preparatory response) (Harung & Travis, 2012). Scores on the Brain Integration Scale systematically increase with TM practice in college students (Travis & Arenander, 2006; Travis, Haaga, *et al.*, 2009).

Brain integration has also been associated with better performance in top managers (Harung, 2009), professional musicians (Travis, *et al.*, 2011), police officers who are resilient to job stress (Charles, *et al.*, 2014), and professional athletes who won medals in the Olympics, World Games or National Games for three consecutive years compared to professional athletes who did not consistently place (Harung, 2011; Harung & Travis, 2012).

These findings are relevant to EfS in regard to the *strategic competence* identified above in the outcomes section. To deal with the wicked problems of the 21st century our students must be prepared to do something about them. They must be prepared to perform at high levels.

Advanced levels of human development. The 'perfectability' of human life is an issue central to the theory and practice of sustainable development. Can humans achieve their goals without compromising future generations ability to do the same? Or must we reduce our needs, scale back our desires? In other words, even if we allow that sustainability will require an adjustment in our values, must it also require adjustments in our satisfaction? When Maharishi first introduced Consciousness-Based Education, one of its goals was to enable students to fulfil their desires.

At the same time, Maharishi introduced a model of human development covering seven "states of consciousness," which helped clarify the changing nature of desire and satisfaction over the life span. In this model, more advanced states entail greater degrees of satisfaction. Moreover, the seventh state, the apex of human development, called "unity consciousness," is purported to be a state in which human beings live in complete fulfillment (Maharishi, 1969). Thus, it would seem, according to this model, that sustainable development may be attainable at least in equal parts through internal shifts in their perception, as through outer shifts in their possessions or circumstances.

Empirical research on Maharishi's model of human development began using the Personality Orientation Inventory inspired by Maslow's

theory of self-actualization (Maslow, 1971). This research culminated in a meta-analysis of the effects of regular practice of the Transcendental Meditation technique on self-actualization (Alexander, *et al.*, 1991). It found an effect size of .78 associated with the practice of the Transcendental Meditation technique, more than three times the effect size found from studies of other relaxation and meditation techniques. Later research on university students at a Consciousness-Based institution using the Loevinger's sentence completion test also found 53% of graduates ten years after graduation from a CBE institution at a post-conventional level, compared to 12-18% of students at non-CBE institutions (the adult norm is 10%) (Chandler, *et al.*, 2005). Brown used the same measure but over 2-4 years of Consciousness-Based Education and found 30% of graduating seniors to be at the post-conventional level (Brown, 2008).

Two other sources have found useful corroboration for Maharishi's model, if not for the impact of CBE on human development. Pearson (2015) has assembled impressive evidence from scientists, philosopher, poets, and religious leaders throughout history documenting experiences of all four advanced higher states of consciousness (transcendental consciousness, Cosmic consciousness, glorified cosmic consciousness, and unity consciousness).

Based on this research it seems highly likely that these experiences are possible for humankind. Using a different methodology Nader (1995) has discovered precise parallels between human anatomy and physiology and the structures and functions of the Vedic Literature, indicating, as he has expressed, that "The specialized components, organs, and organ systems of the human physiology, including all the various parts of the nervous system, match the 37 branches of the Vedic Literature one to one, both in structure and function" (p. 253). This discovery gives hope that the physiology, if handled properly, might be able to match the depth and beauty of extensive literature of the Vedas.

In summary, the research, empirical and otherwise, suggests that it is possible to apply a system of education that can reliably and systematically culture human beings in the direction of a more satisfying experience in life, one that continues to progress without necessarily acquiring more or gaining more power over others.

A POSITIVE IMPACT ON THE ENVIRONMENT

An implicit theme of the 2030 UN Agenda (see above) is reducing conflict at every level, starting with the family and ending with international relations. Other organizations, such as the Millennium Project (2014), specifically identify "peace and conflict" as one of their 15 global challenges to sustainable development. Consciousness-Based Education is the only educational approach of which we are aware that has a documented impact on social conflict, as measured by publicly available data. Peace or conflict resolution is not approached through intellectual analysis in CBE, rather it is a by-product of the brain coherence discussed above when the TM technique is practiced at a CBE institution. The model proposed to explain the discovered effect is a "field theoretic model" (Dillbeck, *et al.*, 1988), suggesting that consciousness is a field, which the individual mind can both stimulate and be stimulated by. Specifically, using sophisticated time-series analyses that controls for known confounds, individual or, in some cases, group practice of the Transcendental Meditation technique has been found to:

- decrease crime (Dillbeck, *et al.*, 1988; Dillbeck, *et al.* (1981); Hagelin, *et al.*, 1999);
- reduce violent death (Dillbeck, 1990);
- improve quality of life (Dillbeck, *et al.*, 1987; Assimakis & Dillbeck, 1995; Orme-Johnson, *et. al*., 1988);
- reduce war and conflicts (Orme-Johnson, *et al.*, 1988; Davies & Alexander, 2005); and
- improve international relations (Gelderlos, *et al.*, 1990).

This body of research presents an entirely new dimension of possibilities to EfS. It suggests that schools employing Consciousness-Based Education can have a calming effect on their region, and in this way contribute to the goals of sustainable development.

RESOLVING THE ISSUES

Having reviewed the research on CBE in light of the current state of Education for Sustainability, we turn next to addressing the issues we have identified one by one.

Distinguishing between general and special training for sustainability. We noted earlier the similarities between the goals of general education or liberal education identified by the American Association of Colleges and Universities and the 21st Century Skills identified by Partnership for 21st Century Learning for K-12 education. Every educational institution must ask itself what knowledge and skills all students should have and what might be the study for just those who want to go more deeply into a specialization, such as sustainability science? A corollary question is should the general education component of SE be in a single course or integrated into all courses? Though we do not have a final answer to these questions, we will make a recommendation.

We do believe that the demands of sustainability are so central to our future and so challenging for every society that all students at the elementary, secondary, and tertiary levels should be introduced to sustainability issues in every field as an aspect of instruction in that field. The goal of this aspect of their study should be to support students' ability to live in a way that is sustainable: minimizing one's carbon footprint, supporting equity for all peoples and countries, producing and consuming goods that place the least demand on scarce resources, finding fulfillment in the quality of one's life rather than the quantity of things one has acquired, etc. Thus, teachers must learn to teach sustainable mathematics, sustainable language study, and sustainable social studies, in addition to sustainability science. At the same time, both school and university need to work toward being examples of sustainable organizations.

Beyond this general competence in local and global citizenship, a course at the secondary level and a major at the collegiate level should be available to prepare agents for sustainable development, people who are gaining the competencies needed to help others toward a sustainable future.

Dispositions and values for EfS. As mentioned earlier, we hold that dispositions, though difficult to teach directly, need to be part of the

intended outcomes of any sustainability science program. In our extensive research, we have not come across a set of dispositions specifically focused on sustainability. The closest we have found is a set of basic principles of "deep ecology" in Andres Edwards' book, *The Sustainability Revolution* (2005), including such statements as

> The well-being and flourishing of human and non-human Life on Earth have a value in themselves (synonyms: intrinsic value, inherent value). These values are independent of the usefulness of the nonhuman world for human purposes. (p. 115)

This particular belief has within it a value and therefore a disposition to behave in a certain way toward non-human life. We happen to agree with this belief, however there is probably a simpler list that expresses the care that we must have for future generations, for clean water and air, for biodiversity, for equity, and for peace, before progress on sustainability is possible; but we have not seen such a list and the generation of such a list goes beyond the scope of this paper. Suffice it for now that each sustainability science program needs to consider the values central to the enterprise, and faculty and students who wish to make a career in the field should examine critically and regularly their basic beliefs and dispositions to see if their desires align with other workers in this field. Such critical examination also gives students and faculty the opportunity to alter or develop these basic beliefs.

Teaching sustainability science *and* sustainable living. There are two trunks to the sustainability tree: one we call sustainability science, which looks to policy and strategies to develop a sustainable world; the other one we call sustainable living, which looks to how we as humans need to view the world and behave so that we can get along with ourselves and our planet. CBE has a contribution to make to both trunks, but particularly to the sustainable living one. We have summarized the research on CBE to support the claim that, with the proper technologies for the development of consciousness, humans are capable of living in advanced levels of human development (cf. Alexander, 1990), where abundance and peace can co-exist. In our reading of the sustainability literature to date, it is highly questionable whether a sustainable future is possible without such technologies. A single-minded drive to raise the standards of living around the world

through acquisition of the technologies and resource-hungry habits of the 20th century seems doomed to failure.

Transdisciplinary research and problem solving. The summary of current thinking on EfS makes clear the centrality of interdisciplinary thinking to sustainability. As with life as a whole, the problems that we as a species face are not disciplinary problems, even though they necessitate continued progress in many areas of specialized knowledge. Sustainability students must learn to draw upon and integrate specialized knowledge from many fields, looking for emergent solutions at the intersection of disciplines. They must be like societal engineers, using physical and social science, humane and artistic reasoning, to design new possible futures for groups, organizations, and political entities.

To conduct this imaginative work, both in research and problem solving, these students will need to be capable of finding patterns within highly divergent disciplines, languages, cultures, and organizations. In my summary of the kind of thinking that Consciousness-Based Education supports, where modern science is integrated with personal experience and traditional wisdom (including but not limited to Vedic Science), we have tried to give a hint of the kind of thinking that goes beyond a mix of disciplines to a kind of transdisciplinary thinking, also called holistic thinking. In this thinking, every part of knowledge is connected to the whole of knowledge in a field, and the field is connected to the deepest levels of my self.

Compartmentalization of modern discipline-centered instruction. This is a curricular issue, in that most colleges and universities are run by departments and most department faculty are trained in a discipline other than sustainability science. It is also a knowledge issue in that the general direction of disciplinary progress is toward increasing specialization, whereas sustainability science is an inter-discipline competing with other established disciplines which have proven themselves and their methods. CBE addresses this issue by introducing a new discipline, called Maharishi Vedic Science, that looks at phenomena from the standpoint of human consciousness. It has parallels to the newly emerging integral theory and integral education (Esbjorn-hargens, *et al.*, 2010) in that that seeks to bring together subjective and objective approaches to knowledge. It is unique in that it approaches this integration not from the standpoint of intellectual

analysis and reflection, but through the integration of experience and understanding about consciousness as revealed in the practice of a simple meditation technique, Transcendental Meditation. This new discipline provides a natural home for the study and development of interdisciplinary knowledge and skill.

Preparing faculty to use more advanced pedagogies. We highlighted here the importance of training a new generation of teachers, at K-12 and college levels, with new teaching methods such experiential learning, storytelling, values education, enquiry learning, etc., that UNESCO outlines on its website. The challenges of sustainability call for methods that are simply more effective than those previously used in changing the worldviews, institutions, and technologies that we currently live in. While CBE has advantages that can be utilized by todays teachers and professors, Consciousness-Based educators also will need training in many of these emerging methodologies of teaching that are more immersive, more value-conscious, more interactive and experiential than previously used by educational institutions. Institutions will have to commit resources to training its faculty in the most effective pedagogies for changing perspectives and behaviours.

Putting it all together: Sustainability skill sets for all students. We have reviewed sustainable development goals, as well as the competencies, the curricula, and teaching methods of Education for Sustainability. We have looked at the theory and research on Consciousness-Based Education, in order to assess the value that CBE brings to EfS. In the previous section we proposed solutions to the outstanding issues and challenges of EfS based in the theory and research on CBE. In this final section, we present a model of post-secondary EfS.

Figure 1 depicts a simple model of EfS beginning with the foundation of sustainability, the ability to understand and experience the basis of consciousness in the self—or self-knowledge. What this foundation assumes is that education in order to prepare students to live happily and sustainably will require a deeper, more stable foundation for education than previously presumed and this foundation is knowledge of one's innermost self.

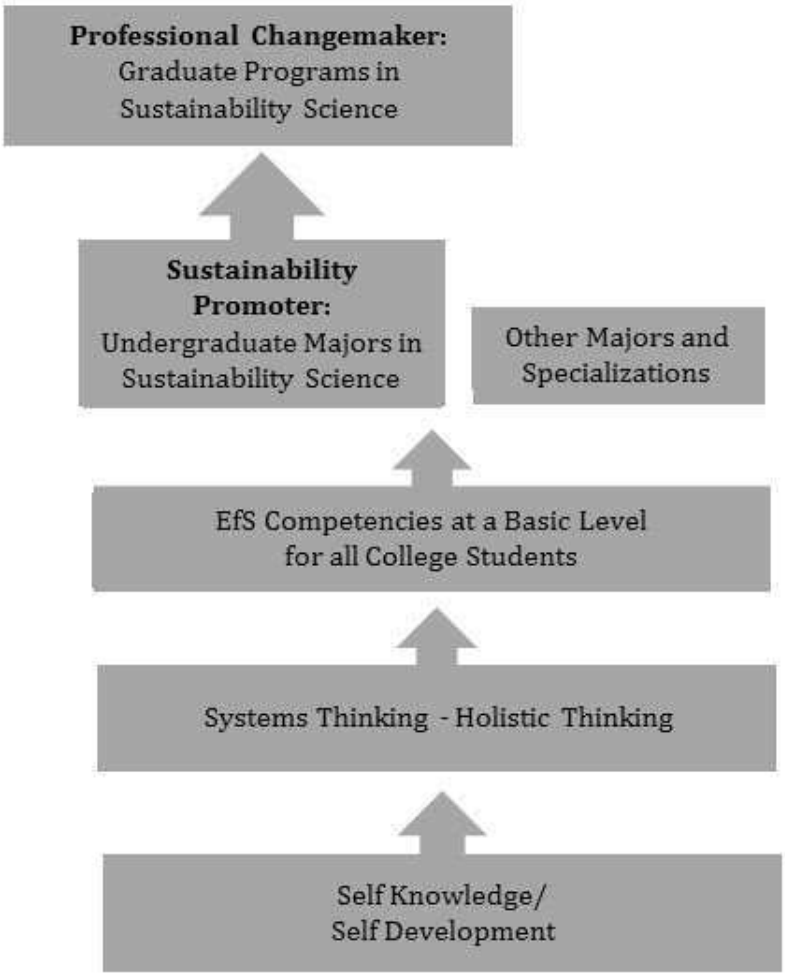

Figure 1. Model of Education for Sustainability at the post-secondary level.

Moving up the chart, at the next level the model also suggests that all students need to develop a language and mode of thinking that transcends disciplinary boundaries, that looks for patterns and principles that are truly transdisciplinary. One approach to this kind of thinking is called "systems thinking," a mode of thinking familiar to the EfS community. With Consciousness-Based Education we label it "holistic thinking," a kind of systems thinking that sees the knower,

knowing, and known as part of one system of consciousness, but based in the experience of a unified consciousness. This kind of holistic thinking, we argue, is more likely to guarantee the kind of transdisciplinary view needed for sustainability work.

At the next level, all students should learn general skills or competencies that prepare them to live sustainably (remember the distinction between sustainability science and sustainable living). They must learn the five competencies that Wiek, *et al.* (2011) have identified as sustainable living competencies, though at basic level. It must be remembered that every competency is learned at various levels depending upon many factors, including, for example, the number of opportunities to learn it and students' maturity. Our assumption, illustrated by this model, is that all students in college should be exposed to and expected to develop to a "basic level" these general competencies. At the next, more advanced, level students split off into "majors" or "specializations" based on their interests and abilities. One of these majors should be in sustainability science, where those who choose to learn can acquire the competencies at a more advanced level and learn to analyze modern day problems from the perspective of sustainability science.

At this level, the competencies in sustainability that everyone has gained as an undergraduate are developed to an advanced level, as one prepares to argue for and present sustainability initiatives to the general public. We call this the "promoter level" of competence. These are people who can explain and justify sustainability to others. We expect that there are jobs for such people, as sustainability becomes an increasingly serious public concern.

Graduate programs in sustainability science (MA and Ph.D.) represent the next and final level of sustainability science education where interested students go on to develop the skills of sustainability science changemakers or researchers or both. Graduates of such programs would have mastered the key sustainability competencies at a still higher level than the undergraduates who majored in the same field. Their graduate work would include opportunities to work in collaborative and applied situations, with communities or other organizations, under the guidance of faculty, to develop and execute plans for raising levels of sustainability for interested third parties.

CONCLUSION

We have envisioned a model of Education for Sustainability, based on knowledge and experience of consciousness, that enables students to develop the kinds of competencies outlined by Wiek, Withycombe and Redman (2011), combined with competencies required for development of consciousness and holistic thinking. Adding the two additional competencies not only orients EfS toward radical change, it also allows for a more completely integrated, and therefore practically useful, set of competencies.

The central solution we have highlighted above is the need to develop the kind of person who is capable of looking at the issues as a whole (from a transdisciplinary perspective) and solving them at a deep level. We need to prepare people to solve what appear to the modern mind to be intractable problems. Implicit in this solution is the need for a different kind of consciousness than the one typifying modern life. Otherwise what is likely to happen is that we replace one problem (e.g., poverty) with another (e.g., conflict); or a new problem hitherto unforeseen emerges because we are only looking at one aspect at a time.

The research on CBE, such as that on brain integration or ego development, suggests that it is possible through the technologies of consciousness highlighted in this paper to root out deep stress and activate new levels of human development needed to reconceive old problems and imagine new solutions. This reconceiving to us seems necessary to solve the problems listed in the 2030 Agenda outlined at the start of this paper.

In light of all Maharishi's written work on the development of human society, it seems likely that for him the problems of life on planet earth did not solely have their origins in scarcity of resources or the degradation of the environment, although he did write about these problems (e.g., WGAE, 1978, pp. 9-10). Their origin was instead in stress, in the limitations that stress imposes on human consciousness, and in a lack of unity and harmony with nature due to an inability to experience and live "in accordance with natural law" (WGAE, 1978, p. 9). Thus, the environment reflects the nature of our own minds, our own consciousness. If it is polluted, it is only the natural result of polluted thinking, i.e., murky, short-sighted and narrow-minded thinking, thinking not in accord with natural law. The solution to environmental

degradation, a central aspect of sustainability, is to clean up and refresh the internal environment, i.e., our own consciousness. According to Maharishi (WGAE, 1978, p. 9), "only such unity with nature can guarantee that in our actions we will always protect nature and in turn be protected by it".

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